

Why Does It Work?

A Study of Successful Gender Equity in Industrial Engineering at the University of Oklahoma

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Context: As of Fall 2001, 58% of the undergraduate majors in Industrial Engineering (IE) at the our university (OU) are women. This proportion is strikingly higher than both the nationwide proportion in IE and the proportion in other STEM degree programs at OU based on the Fall of 2000 data (Table 1). Furthermore, the proportion has more than doubled in the space of five years, having steadily increased from 27% in 1996. This phenomenon is especially puzzling because IE at OU did not set out specifically to accomplish gender parity among its undergraduate majors.

Table 1: Proportion of Women in Selected STEM Fields Fall 2000

Participating Departments	OU students ^(b)		students nationwide ^(d)	OU faculty ^(e)		faculty nationwide
IE	47/84	55%	25%	4/10	40%	10% ^(f)
Chem E ^(a)	126/325 ^(c)	39%	33%	1/15	6%	8% ^(f)
Mathematics	24/75	32%	46%	3/29	10%	19% ^(AMS)
Physics	16/75	21%	20%	4/28	14%	8% ^(g)
CS ^(a)	46/312	15%	24%	2/12	17%	11% ^(h)
AME ^(a)	45/338	13%	12%	1/15	6%	6% ^(f)

TABLE 1 NOTES: (a) "Chem E" is Chemical Engineering; "CS" is Computer Science; "AME" is Aerospace & Mechanical Engineering; (b) OU Provost's web page, Fall 2000 data, left column is women/total; (c) Chem E at OU includes material science; (d) U.S. Department of Education (2000a), *Table 257.--Bachelor's, master's, and doctor's degrees conferred by degree-granting institutions, by sex of student and field of study: 1997-98*; (e) Obtained by consulting department personnel; left column is women/total; includes tenured and tenure-track only; (f) Thorsen (1998), *Appendix D: Data on Faculty Rank Comparing Georgia Tech to Benchmark Schools, 1998*; (g) Ivie and Stowe (2000), *Table 4. Percent of Faculty Positions in Physics That Were Held by Women, 1998* (includes Full, Associate, Assistant Professor, and other ranks); (h) Bryant and Vardi, (2002), *Table 21. Gender of Current Faculty* (includes Full, Associate, and Assistant Professors in CS and computer engineering departments that grant Ph.D's)

Methods: For each of the three project years, we will interview students at multiple levels – from sophomore to senior, as well as alumni – thus gathering information about experiences not only from across cohorts but longitudinally following cohorts as they progress through degree programs. As part of our design, we will probe systemic factors that help/hinder departments in their efforts to achieve gender equity goals, an undertaking that will involve additional departments at OU as well as departments at other institutions. This design will enable us to identify *combinations of factors* by targeting departments that vary in the extent to which such factors are present (e.g., departments that have a relatively high proportion of women

faculty and those that have lower proportions). To assure triangulation, other sources of data will include student transcript records, the Pittsburgh Engineering Attitudes Toward Engineering Survey©, and interviews with faculty, program directors, advisors, and graduate students, all of whom affect student experiences in college.

Table 2: Interview Schedule (shading is to illustrate longitudinal aspect)

Interviews 2003		Interviews 2004		Interviews 2005	
IE class of 05 (Sophs)	25	IE class of 06 (Sophs)	25	IE class of 07 (Sophs)	25
IE class of 04 (Juniors)	25	IE class of 05 (Juniors)	25	IE class of 06 (Juniors)	25
IE class of 03 (Seniors)	25	IE class of 04 (Seniors)	25	IE class of 05 (Seniors)	25
IE class of 01,02 (Alum)	10	IE class of 03 (alum)	5	IE class of 04 (alum)	5
75-80% of those interviewed will be women		Chem E, AME, CS, 75 across three cohorts		Chem E, AME, CS, 75 across three cohorts	
		Mathematics, Physics 50 across three cohorts		Mathematics, Physics 50 across three cohorts	
IE at OU interviews: 245 total (75 sophs + 75 juniors + 75 seniors + 20 alumni/ae)				AZ State Univ, Univ of 90 NE, Univ of Pittsburgh, across three cohorts	
total interviews/year	85		205		295
+ approximately 15 switchers from participating departments at OU = 600 total interviews					

Interview Protocol

Student's Background

1. Year in college, major, minor(s).
2. What year were you born? Did you come straight to college from high school?
3. High school background (classes, grades, interest in STEM). Compare high school courses in science and math with your current engineering-related courses (easier/more challenging, teaching styles, etc.).
4. In high school, what did you do when you weren't in class? Outside interests? Extracurricular activities? Sports? Did you have a job?
5. Parents' occupations? Siblings? Other family? Do they like their work? Do you identify with some of them?
6. What do you do when you are not in class or studying? Extracurricular activities? What did you do last Saturday? What would you do if you had time? Family and community responsibilities? Do you have a job?
7. Tell me the story about you and computers (when/how did you get interested)

Attributes of the Institution

8. What brought you to college? Why did you choose OU (or ...) over other schools? What schools did you apply to? Do you have scholarships?
9. Are you involved in student organizations or student professional organizations? Sorority/fraternity? [Why not?] [if not addressed in extracurricular activities]

Attributes of the Field

10. Why did you choose IE (or ...) as a major (especially vs. some other STEM field)?

- a. How did you learn about IE as a major? What experience was most responsible for your decision? Was there anyone who especially encouraged you?
 - b. How would you describe IE? What are the qualities/skills that make a good industrial engineer (or ...)?
 - c. How are those around you (family, friends) responding to your decision?
 - d. How is IE perceived by other in engineering? People not in engineering?
 - e. What interests you most about IE? Least? Interest in IE increased/decreased?
 - f. Do you feel that you and IE are a good fit? Are you happy with your decision? Would you make the same decision if you knew earlier what you know now?
11. What other majors have you considered/pursued? Why those? Why not choose one of those? In what other areas do you maintain an interest? Thoughts about switching out of IE? Why? Why not?

Pedagogy/Curriculum

12. Tell me about the classes you have taken.
- a. Favorite undergraduate class (in IE and other)? Why? Describe a typical class period.
 - b. Least favorite undergraduate class (in IE and other)? Why? Describe a typical class period.
 - c. In general, do you prefer classes that have a lot of lecture, small group work, competition, use of computers, big projects?
 - d. What makes a class easy? Hard? Which do you prefer?
13. How do you learn best? What do you need for an optimum learning experience? Do your professors (in IE and other) provide that? What projects do you like best? Least?
14. Do your professors provide encouragement? What does that look like? Are there moments when you feel discouraged? Has your confidence in your ability to do well in the major/field increased or decreased?

Department Culture

15. What is your best experience with a faculty member? Worst? How often do you interact with faculty? Graduate students? Who are the people who are important to you (role models)/who do you identify with?
16. How often do you interact with other students (in IE and other)? When/where? What kinds of interactions to you have with fellow industrial engineering majors? What kinds of things do you do or talk about? How have these interactions changed over time? Who are the people who are important to you (role models)/who do you identify with?
17. What advice would you give to new students (and/or high school seniors considering engineering at OU)? Is your advice different for women than for men?
18. What advice would you give to faculty? What advice would you give to the decision-makers (about curriculum, policies)?
19. Ideas of why so few women in field at large? Why different at OU? Ideas on what would have to be different to attract/excite more women? What is at OU that "works"?

Student's Future

20. When do you think you will complete the degree?
21. What are your plans for after graduation (career, family, other interests, where to live, financial security)? Where do you see yourself in five years? What do you want a typical day to look like? How will your degree in IE fit into your goals?
22. Experiences with job market/internships, job recruiters, finding employment.
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